

LUNAR RECONNAISSANCE ORBITER CAMERA OBSERVATIONS RELATING TO SCIENCE AND LANDING SITE SELECTION IN SOUTH POLE-AITKEN BASIN FOR A ROBOTIC SAMPLE RETURN MISSION.

B. L. Jolliff¹, R. N. Clegg-Watkins^{1,2}, N. E. Petro³, and S. J. Lawrence⁴, ¹Washington University in St. Louis, St. Louis, MO, 63130 (bjolliff@wustl.edu); ²Planetary Science Institute, Tucson AZ; ³Goddard Spaceflight Center, Greenbelt, MD; ⁴Johnson Space Center, Houston, TX.

The Moon's South Pole-Aitken basin (SPA) is a high priority target for Solar System exploration, and sample return from SPA is a specific objective in NASA's New Frontiers program. Samples returned from SPA will improve our understanding of early lunar and Solar System events, mainly by placing firm timing constraints on SPA formation and the post-SPA late-heavy bombardment (LHB). Lunar Reconnaissance Orbiter Camera (LROC) images and topographic data, especially Narrow Angle Camera (NAC) scale (1-3 mpp) morphology and digital terrain model (DTM) data are critical for selecting landing sites and assessing landing hazards.

Rock components in regolith at a given landing site should include (1) original SPA impact-melt rocks and breccia (to determine the age of the impact event and what materials were incorporated into the melt); (2) impact-melt rocks and breccia from large craters and basins (other than SPA) that represent the post-SPA LHB interval; (3) volcanic basalts derived from the sub-SPA mantle; and (4) older, "cryptomare" (ancient buried volcanics excavated by impact craters, to determine the volcanic history of SPA basin). All of these rock types are sought for sample return. The ancient SPA-derived impact-melt rocks and later-formed melt rocks are needed to determine chronology, and thus address questions of early Solar System dynamics, lunar history, and effects of giant impacts. Surface compositions from remote sensing are consistent with mixtures of SPA impactite and volcanic materials, and near infrared spectral data distinguish areas with variable volcanic contents vs. excavated SPA substrate. Estimating proportions of these rock types in the regolith requires knowledge of the surface deposits, evaluated via morphology, slopes, and terrain ruggedness. These data allow determination of mare-cryptomare-nonmare deposit interfaces in combination with compositional and mineralogical remote sensing to establish the types and relative proportions of materials expected at a given site. Remote sensing compositions, e.g., FeO, also constrain the relative abundances of components. Landing-site assessments use crater and boulder distributions, and slope and terrain ruggedness analysis. Using these criteria, many potential landing regions exist, concentrated near the center of the basin.